ACKNOWLEDGEMENT OF INTERVIEW

An interview, granted by the Examiner and held on Mar 8, 2006, is gratefully acknowledged. During the interview, Claims 1 and 5 were discussed. The applicability of prior art references, U.S. Patent No. 5,786,597 to Lingren, et al., U.S. Patent No. 5,952,646 to Spartiotis, et al., U.S. Patent No. 6,017,634 to Capote, et al., and U.S. Published Application 2003/0229986 to Su, et al., were discussed.

REMARKS

Reconsideration and withdrawal of the rejections set forth in the Office Action dated July 18, 2006, is respectfully requested in view of this amendment. By this amendment, the Specification has been amended to correct a reference to one of the inventor's patents, US Pat. 5,985,043. This had appeared as "US Pat. 5,985,053" in the original specification. New claim 20 has been added, setting forth the radiation detector assembly fabricated in accordance with the method of claim 5. It is respectfully submitted that the above amendments introduce no new matter within the meaning of 35 U.S.C. §132.

Claim 1 has been amended to describe the an interposer card as comprising a comprises a ceramic or polymer laminate printed circuit, in addition to the interposer card having planar dimensions no larger than planar dimensions of the semiconductor detector array substrate. Support for this change is found in the original specification, in the first paragraph of the Detailed Description of the Invention. Claim 5 has been amended to describe the plurality of discrete solder bumps as having a low temperature melting point. Claim 5 also now describes heating the combined unit in a manner with bonding to the detector substrate accomplished by aligning and contacting the discrete solder bumps to the solder coating electrodes of the detector, followed by solder reflow of the low-melting point solder without reflow of the solder barrier metallization. Support for these limitations is found throughout the specification, including page 8, lines 8-11. Both independent claims (claims 1 and 5) have been amended to recite that, "the

cured encapsulating resin provides mechanical stability to the solder joints having a melting point or liquidus less than 120 degrees C connecting the semiconductor chip and interposer card by adding mechanical strength to the assembly." (claim 1; claim 5 is similar) Support for this language is found in the description on page 5, lines 8-16 (first paragraph of the Summary). It is respectfully submitted that the above amendments to the claims introduce no new matter within the meaning of 35 U.S.C. §132.

Claims 1-20 are pending in this application. In the Final Office Action, claims 1-17 were rejected under 35 USC 103(a). Contrary to what is stated on the face of the Office Action, it is noted that claims 18 and 19 were not rejected for any reason. In view of the remarks set forth, Applicant respectfully requests reconsideration.

Rejections under 35 USC §103

Claims 1-17 were rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 5,786,597 to Lingren, et al. (*Lingren*), taken in view of U.S. Patent No. 5,952,646 to Spartiotis, et al. (*Spartiotis*), U.S. Patent No. 6,017,634 to Capote, et al. (*Capote '634*), and U.S. Published Application 2003/0229986 to Su, et al. (*Su*).

Response

Reconsideration and withdrawal of the rejection is respectfully requested because the prior art, taken in combination, fails to teach or suggest all of the features recited in claims 1-17.

In the rejection, *Lingren* is cited as showing a radiation detector with a substrate, interposer and interconnect pads, but not showing the use of a solder having a m.p. of less than 120°C. *Spartiotis* was used to show the use of a low temperature solder for merging a detector and an interposer. The rejection states that this is analogous art because both *Lingren* and *Spartiotis* use solder bump processes. *Capote '634* is used to show the use of an encapsulant between an interposer and a detector.

The use of an encapsulation less than 120°C is cited as taught by *Capote '634*, with Okuno, et al., U.S. Patent No. 6,579,748 newly applied to show encapsulating resin at temperatures of 100°-150°. There is no suggestion that such resins be used in conjunction with a solder having a melt temperature of no greater than 120°C. This is significant because the mechanical strength of low temperature solder (e.g., < 120°) is poor. Therefore in addition to providing a material in which the residual fluxing agent is non-corrosive (and therefore does not need to be washed away or removed), the resin must have the mechanical strength necessary for the low temperature solder.

This is different from *Capote '634* in that *Capote '634* describes, the resins as optional:

> "The thermally curable adhesive composition does not require resins; further, compositions that do not include resins tend to have longer pot lives and lower viscosities during solder reflow. However, as an option, a resin can be employed and it functions to increase the adhesion of the cured composition to the substrate and to increase the cohesive strength and glass transition temperature of the cured composition." *Capote '634* at col. 11, lines 19-26.

Therefore, the *Capote '634* reference would not be properly combined with the other references to show the feature of using the resin with the low temperature solder while maintaining mechanical strength of an assembly. Without the combination of the resin with the low temperature solder, other means would be required to provide mechanical strength to the assembly.

The arguments filed on 2/21/2006 were deemed non-persuasive because the references were attacked individually. It is respectfully submitted that, while the features of the references were described in connection with the corresponding reference, the entire combination of the references was discussed. The mere discussion of a characteristic of one invention does not mean that that reference is distinguished in the absence of other cited references.

The combination was cited with reference to a failure to show arrangements in which solder bumps are used in assembly involving interposer assemblies, the use of a solder having a

m.p. of less than 120°C, the use of an encapsulating resin that could be cured either during or after solder reflow, but at a low temperature consistent with the preservation of the integrity of the radiation sensor array.

Significantly, *the combination* is devoid of a suggestion of using an encapsulating resin curing at a temperature no greater than 120°C in combination with the use of a solder having a m.p. of less than 120°.

This is not a mere matter of semantics regarding "the combination" because the claimed feature is the use of an encapsulating resin curing at a low temperature which also cures during (or after) solder reflow. The combination is significant because it also allows cure without damaging the heat-sensitive sensor assembly. Therefore, the prior art of record fails to show or suggest this feature.

More specifically, the combination itself must be applied to the invention as claimed. Therefore in order to establish a prima facie case of obviousness, the Examiner must establish:

(1) that some suggestion or motivation to modify the references exists;

(2) a reasonable expectation of success; and

(3) that the prior art references teach or suggest all the claim limitations.

Amgen, Inc. v. Chugai Pharm. Co., 18 USPQ2d 1016, 1023 (Fed. Cir. 1991); *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988); *In re Wilson*, 165 USPQ 494,496 (C.C.P.A. 1970). It is respectfully submitted that the combination of references fails to teach or suggest all the claim limitations.

The prior art combination must be internally consistent without "hindsight" application of the Applicants' invention. When combining references, it is necessary that this be done in a manner consistent with the references themselves. This configuration is contrary to the description found in *Lingren*, which uses the pre-assembled plate 230, and is contrary to *Spartiotis* which clearly provides free space between the solder bumps as part of the assembly. This configuration is not described in *Capote '634* because there is no suggestion in *Capote '634*

that the encapsulant must cure at 120°C or less. For this reason, there is no prior art suggestion of the use of the combination of the resin with the low temperature solder for the purpose of providing mechanical strength as a substitute for mechanical strength otherwise afforded by the solder joints.

The cited combination fails to disclose the features of claims 1 and 5 of the claimed invention. As set forth in the previous amendment, independent claim 1 recites:

> "... an interposer card ..., a plurality of interconnect pads ..., at least one readout semiconductor chip and at least one connector ...; solder columns that extend from contacts on the interposer first surface to the plurality of pads ... said solder columns comprising at least one solder having a melting point or liquidus less than 120 degrees C; and an encapsulating resin ..., said encapsulating resin curing at a temperature no greater than 120 degrees C ... the cured encapsulating resin provides mechanical stability to the solder joints having a melting point or liquidus less than 120 degrees C connecting the semiconductor chip and interposer card by adding mechanical strength to the assembly."

Independent claim 5, as amended, recites:

> "... providing a semiconductor detector array substrate comprising CdZnTe or CdTe having a plurality of metallized detector cell pads ... providing an interposer card ... a plurality of ... solder bumps ... at least one bump corresponding to at least one pad ... disposing an encapsulating resin as a fluxing agent and encapsulant between the interposer card and the semiconductor detector array substrate, the encapsulating resin having a curing temperature no greater than 120 degrees C; mating the interposer card ... to the semiconductor detector array substrate ...; heating the combined unit to a temperature not exceeding 120 degrees C ... and at the same time allowing said encapsulating resin to at least partially cure ... fully curing the encapsulating resin a temperature no greater than 120 degrees C ... the cured encapsulating resin provides mechanical stability to low melting point solder joining the semiconductor chip and interposer card assembly by adding mechanical strength to the assembly."

This combination, as set forth in the independent claims, defines a structure, which, despite the inherent weakness of the low eutectic temperature solder, has a substantial degree of

mechanical strength. This is the result of the claimed combination of the encapsulating resin (e.g., acrylic resin) and the ability of the encapsulating resin to set during or after solder reflow. The Examiner is correct in that acrylic material is not called out in the specification, except by incorporation by reference. The specification does, however, call out encapsulating resin. The encapsulating resin performs the inventive function. Therefore, while acrylic resin was described in the previous Response with respect to the function, the function itself is in fact recited in the claims in the form of the encapsulating resin, and is fully consistent with the use of acrylic resin as encapsulating resin. The prior art fails to suggest that an encapsulating resin be cured either during or after solder reflow, but at a low temperature consistent with the preservation of the integrity of the radiation sensor array. There is no suggestion in the prior art of record of using an encapsulating resin curing at a temperature no greater than 120°C.

Applicants have identified encapsulating resin curing at a low temperature, which permits the use of a material which allows cure without damaging the heat-sensitive sensor assembly. The prior art of record, *taken in combination*, fails to show or suggest this feature.

Furthermore, as pointed out in Applicants' prior Response, this configuration is contrary to the description found in *Lingren*, which uses the pre-assembled plate 230, and is contrary to *Spartiotis* which clearly provides free space between the solder bumps as part of the assembly. This configuration is also contrary to *Capote '634*, which does not specify that the encapsulant must cure at 120°C or less. It is respectfully pointed out that the combination must be internally consistent under 35 USC 103.

Dependent claims 2-4 and 6-19 should be allowed for the same reasons that their parent claims should be allowed. Specifically, the claimed features in these claims are relevant to the inventive features defined in the independent claims.

It is noted that, while claims 18 and 19 were not specifically rejected, *Capote '634* is cited, with respect to claims 18 and 19 as describing reflow of solder with a low melting point. Again, this citation of *Capote '634* fails to suggest the underlying invention as including the

limitations of claim 5. As applicants disagree with the basis for rejection of claims 5, 9 and 10, it is respectfully requested that details of the applicability of the cited art to Claims 18 and 19 be provided.

Therefore, claims 1-19, and new claim 20, as currently presented define over the prior art of record, and are believed to overcome the obviousness rejection. Applicant respectfully request that the Examiner withdraw the rejections and the case be passed to issuance.

CONCLUSION

In light of the foregoing, Applicants submit that the application is in condition for allowance. If the Examiner believes the application is not in condition for allowance, Applicants respectfully request that the Examiner call the undersigned.

Respectfully submitted,
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